



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/673,583	09/30/2003	Andrej S. Mitrovic	230420US6YA	1606
22850	7590	09/20/2005	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			SAXENA, AKASH	
			ART UNIT	PAPER NUMBER
			2128	

DATE MAILED: 09/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/673,583

Applicant(s)

MITROVIC, ANDREJ S.

Examiner

Akash Saxena

Art Unit

2128

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-62 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-62 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>12/10/03</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-62 have been presented for examination based on the application filed on 30th September 2003.

Specification

2. Claims 15-16, 42-43 & 61 are objected because of improper dependency.
3. MPEP § 608.01(n) states:

A series of singular dependent claims is permissible in which a dependent claim refers to a preceding claim which, in turn, refers to another preceding claim.

A claim, which depends from a dependent claim, should not be separated by any claim, which does not also depend from said dependent claim. It should be kept in mind that a dependent claim may refer to any preceding independent claim. In general, applicant's sequence will not be changed. See MPEP § 608.01(n).

Claims 15-16 dependent on claim 3, claims 42-43 dependent on claims 30 and claim 61 dependent on claim 41, are objected to for the reasons disclosed above.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claim 62 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claim 62 discloses "computer readable medium" which is defined in the specification (Pg.32-33 [00103] Line1-9) to include tangible items ("non volatile media" and "volatile media") and items that are non-tangible ("transmission media"). Therefore the claim as whole is not directed towards a tangible medium. One possible suggested way to overcome this rejection is to replace "computer readable medium" with "non volatile media" and "volatile media".

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

- 5. Claim 1 provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/673,501.**

Application No. 10/673,583	Application No. 10/673,501
A method of facilitating a process performed by a semiconductor processing tool, comprising:	A method of facilitating a process performed by a semiconductor processing tool, comprising:
inputting data relating to a process performed by the semiconductor processing tool;	inputting data relating to a process performed by the semiconductor processing tool;
inputting a first principles physical model relating to the semiconductor processing tool;	inputting a first principles physical model relating to the semiconductor processing tool;
performing first principles simulation using the input data and the physical model to provide a <u>virtual sensor measurement relating to the process</u> performed by the semiconductor processing tool; and	performing first principles simulation using the input data and the physical model to provide a <u>simulation result for the process</u> performed by the semiconductor processing tool; and
using the <u>virtual sensor measurement to facilitate</u> the process performed by the semiconductor processing tool.	using the <u>simulation result as part of a data set that characterizes</u> the process performed by the semiconductor processing tool.

Although the conflicting claims are not identical, they are not patentably distinct from each other because both the virtual sensor measurements are the same

Art Unit: 2128

simulation result (Specification: Page 13[0051] Last sentence). Further, the process of facilitating could be a characterization the semiconductor fabrication process (Specification: Page 6[0032] Lines 1-5). This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

- 6. Claim 1 provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/673,507.**

Application No. 10/673,583	Application No. 10/673,507
A method of <u>facilitating</u> a process performed by a semiconductor processing tool, comprising:	A method of <u>controlling</u> a process performed by a semiconductor processing tool, comprising:
inputting data relating to a process performed by the semiconductor processing tool;	inputting data relating to a process performed by the semiconductor processing tool;
inputting a first principles physical model relating to the semiconductor processing tool;	inputting a first principles physical model relating to the semiconductor processing tool;
performing first principles simulation using the input data and the physical model to provide a <u>virtual sensor measurement relating to the process</u> performed by the semiconductor processing tool; and	performing first principles simulation using the input data and the physical model to provide a <u>first principles simulation result</u> ; and
using the <u>virtual sensor measurement to facilitate</u> the process performed by the semiconductor processing tool.	using the <u>first principles simulation result to control</u> the process performed by the semiconductor processing tool..

Although the conflicting claims are not identical, they are not patentably distinct from each other because both the virtual sensor measurements are the same simulation result (Specification: Page 13[0051] Last sentence). Further, the process of facilitating is also same as providing the simulation results to control the actual semiconductor processing tool. This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

7. Claim 1 provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 10/673,138.

Application No. 10/673,583	Application No. 10/673,138
A method of facilitating a process performed by a semiconductor-processing tool, comprising:	A method of facilitating a process performed by a semiconductor-processing tool, comprising:
inputting data relating to a process performed by the semiconductor processing tool;	inputting data relating to a process performed by the semiconductor processing tool;
inputting a first principles physical model relating to the semiconductor processing tool;	inputting a first principles physical model relating to the semiconductor processing tool;
performing first principles simulation using the input data and the physical model to provide a <u>virtual sensor measurement relating to the process performed by the semiconductor processing tool</u> ; and	performing first principles simulation using the input data and the physical model to provide a <u>first principles simulation result</u> ; and
using the virtual sensor measurement to facilitate the process performed by the semiconductor processing tool.	using the <u>first principles simulation result</u> to facilitate the process performed by the semiconductor processing tool.

Although the conflicting claims are not identical, they are not patentably distinct from each other because both the virtual sensor measurements are the same simulation result (Specification: Page 13[0051] Last sentence). This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Further, all the three non-statutory obviousness-type double patenting rejections for the application have substantially same or identical specification. Also, independent claims belonging different statutory category, having substantially similar limitations, in the three co-pending applications may also have similar double patenting rejections.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

- 8. Claims 1-11, 13-14, 17-19, 21-27, 28-32, 33-38, 40-41, 44-46, 48-54, 55-57 and 60-62 rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,802,045 issued to Sonderman et al (Sonderman hereafter).**

Regarding Claim 1

Sonderman teaches a method to facilitate a process performed by a semiconductor-processing tool (Sonderman: Summary, at least in Col.2 Lines 10-17; Col.3 Lines 45-49) by inputting data relating to the process performed by the semiconductor-processing tool (Sonderman: at least in Col.3 Lines 50-67). Further, Sonderman teaches inputting the first principle physical model relating to the semiconductor-processing tool (Sonderman: at least in Col.5 Lines 11-17; 49-67) as device physics model, a process model and an equipment model. Further, Sonderman teaches performing first principle simulation using the input data and the physical model to provide virtual sensor measurements relating to the process performed by the semiconductor-processing tool (Sonderman: at least in Col.5-7). Further, Sonderman teaches using the virtual sensor measurements to facilitate the process

performed by the semiconductor-processing tool (Sonderman: at least in Col.4 Lines 48-64; Fig.1-8).

Regarding Claim 2

Sonderman teaches directly inputting the data relating to the process performed by the semiconductor-processing tool from at least one of physical sensor (eg. Scatterometry data, overlay data, dimensional data) and a metrology tool physically mounted on the semiconductor-processing tool (Sonderman: at least in Col.4 Lines 31-48; Col.4-8; Fig.1, 7).

Regarding Claims 3-5

Sonderman teaches indirectly inputting the data relating to the process performed by the semiconductor-processing tool from one of the manual input devices and a database as manual fashion data retrieval and automatic data retrieval; inputting data recorded from the previous run; inputting the data set by a simulation operator ((Sonderman: at least in Fig.1-3 Col.1; Col.4-7).

Regarding Claims 6-9

Sonderman teaches inputting data relating to at least one of the physical characteristics of the semiconductor-processing tool and semiconductor tool environment, data relating to at east on of the characteristics and a result of a process performed by the semiconductor processing tool; inputting a spatially resolved model (as modified models) of the geometry of the semiconductor processing tool; inputting fundamental equations necessary to perform first principle

simulation for the desired simulation result (Sonderman: at least in Col.5 Lines 10-18; Col.6 Lines 48-63; Col.9 (equations); Col.5-9; Fig 1-3).

Regarding Claim 10

Sonderman teaches performing interaction concurrently between the simulation environment (first principle simulation) and the semiconductor-processing tool (Sonderman: Fig.2; Col.4 Lines 48-63).

Regarding Claim 11

Sonderman teaches repeating the step of inputting the data from (physical sensor) metrology tool into first principle simulation and facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process (Sonderman: at least in Col.4 Lines 48-Col.5 Lines 10; Col.7 Lines 36-53; col.4-7).

Regarding Claims 13-14

Sonderman teaches performing first principle simulation not concurrently with the process performed; inputting data from at least one initial condition recorded from a previous process performed (Sonderman: at least in Col.5-8; Fig.3-4).

Regarding Claim 17

Sonderman teaches using virtual sensor measurements to characterize the semiconductor-processing tool (Sonderman: at least in Col.5 Lines 11-17; equipment model).

Art Unit: 2128

Regarding Claim 18

Sonderman teaches using virtual tool measurements to control the process performed by the semiconductor-processing tool (Sonderman: at least in Col.5 Lines 41-47).

Regarding Claim 19

Sonderman teaches using virtual sensor measurements to detect a fault in the process performed by the semiconductor-processing tool (Sonderman teaches: at least in Col.7, Fig 5-6).

Regarding Claims 21-25

Sonderman teaches using a network of interconnected resources to perform at least one of the process steps recited in claim 1; using code parallelization among interconnected computational resources to share the computational load of the first principle simulation; sharing simulation information among the interconnected resources to facilitate a process by the semiconductor-processing tool; sharing simulation results among the interconnected resources to reduce redundant execution of substantially similar first principle simulation by different resources; sharing information comprising model changes among the interconnected resources to reduce the redundant refinements of first simulation by different resources (Sonderman: Fig.1-3, computer code software is described in Col.9 Lines 58 onward; Col.5-8).

Regarding Claims 26-27

Sonderman teaches remote access to computational and storage resources (Sonderman: Col.9 Line 58-Col.10 Line 31) where in wide area network is art inherent.

Regarding Claim 28

System claim 28 discloses substantially similar limitations as method claim 1 and is rejected for the same reasons as claim 1.

Regarding Claim 29

System claim 29 discloses substantially similar limitations as method claim 2 and is rejected for the same reasons as claim 2.

Regarding Claims 30-32

System claims 30-32 disclose substantially similar limitations as method claims 3-5 and are rejected for the same reasons as claims 3-5.

Regarding Claims 33-36

System claims 33-36 disclose substantially similar limitations as method claims 6-9 and are rejected for the same reasons as claims 6-9.

Regarding Claim 37

System claim 37 discloses substantially similar limitations as method claim 10 and is rejected for the same reasons as claim 10.

Regarding Claim 38

System claim 38 discloses substantially similar limitations as method claim 11 and is rejected for the same reasons as claim 11.

Regarding Claims 40-41 and 61

System claims 40-41 and 61 disclose substantially similar limitations as method claims 13-14 and are rejected for the same reasons as claims 13-14.

Regarding Claim 44

System claim 44 discloses substantially similar limitations as method claim 17 and is rejected for the same reasons as claim 17.

Regarding Claim 45

System claim 45 discloses substantially similar limitations as method claim 18 and is rejected for the same reasons as claim 18.

Regarding Claim 46

System claim 46 discloses substantially similar limitations as method claim 19 and is rejected for the same reasons as claim 19.

Regarding Claims 48-52

System claims 48-52 disclose substantially similar limitations as method claims 21-25 and are rejected for the same reasons as claims 21-25.

Regarding Claims 53-54

System claims 53-54 disclose substantially similar limitations as method claims 26-27 and are rejected for the same reasons as claims 26-27.

Regarding Claim 55

System claim 55 discloses substantially similar limitations as method claim 1 and is rejected for the same reasons as claim 1.

Regarding Claim 56

System claim 56 discloses substantially similar limitations as method claim 10 and is rejected for the same reasons as claim 10.

Regarding Claim 57

System claim 57 discloses substantially similar limitations as method claim 11 and is rejected for the same reasons as claim 11.

Regarding Claim 60

System claim 60 discloses substantially similar limitations as method claim 22 and is rejected for the same reasons as claim 22.

Regarding Claim 62

System claim 62 discloses substantially similar limitations as method claim 1 and is rejected for the same reasons as claim 1.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 12, 15-16, 20, 39, 42-43, 47, 58-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,802,045 issued to Sonderman et al (Sonderman hereafter), in view of U.S. Patent No. 5,719,796 issued to Vincent M.C. Chen (Chen hereafter).

Regarding Claim 12

Teachings of Sonderman are disclosed in claim 1 rejection above. Sonderman teaches setting boundary condition for first principle simulation through the process parameters (Sonderman: at least in Col.5-6).

Sonderman does not teach performing time dependent concurrent simulation without direct input from semiconductor process to facilitate semiconductor process based on virtual sensor measurement.

Chen teaches time dependent concurrent simulation without direct input from semiconductor process and applies the result to facilitate the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process. Chen teaches simulation based on the statistical data, which in turn provides the output to actual fabrication process (Chen: at least in Col.3 Lines 12-18)

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to apply the teachings of Chen to Sonderman. The motivation to combine would have been that Chen and Sonderman both are analogous art concerned with simulating the semiconductor fabrication process and providing the best control parameters to the actual semiconductor-processing tool (Chen: at least in Col.3 Lines 19-23).

Regarding Claim 15

Chen teaches indirectly putting best-known input parameters for the physical model (Chen: at least in Col.3 Lines 19-23).

Regarding Claim 16

Chen teaches comparing virtual sensor measurements with the actual sensor measurements and refining at least one best known input parameters and the physical model to obtain better agreement between the virtual sensor measurements with actual sensor measurements (Chen: at least in Col.3 Lines 48-57; Calibrate run calibrate simulated).

Regarding Claim 20

Chen teaches storing virtual sensor measurement in a library for subsequent use in a first principle simulation (Chen: at least in Col.3; Specifically in Col.3 Lines 37-41).

Regarding Claim 39

System claim 39 discloses substantially similar limitations as method claim 12 and is rejected for the same reasons as claim 12.

Regarding Claim 42

System claim 42 discloses substantially similar limitations as method claim 15 and is rejected for the same reasons as claim 15.

Regarding Claim 43

System claim 43 discloses substantially similar limitations as method claim 16 and is rejected for the same reasons as claim 16.

Regarding Claim 47

System claim 47, discloses substantially similar limitations as method claim 20 and is rejected for the same reasons as claim 20.

Regarding Claim 58

System claim 58 discloses substantially similar limitations as method claim 12 and is rejected for the same reasons as claim 12.

Regarding Claim 59

System claim 59 discloses substantially similar limitations as method claim 16 and is rejected for the same reasons as claim 16.

Conclusion

10. All claims are rejected.

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

12. **Examiner's Note:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant.

Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

Art Unit: 2128

Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Akash Saxena whose telephone number is (571) 272-8351. The examiner can normally be reached on 8:30 - 5:00 PM M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jean R. Homere can be reached on (571)272-3780. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Akash Saxena
Patent Examiner GAU 2128
(571) 272-8351
Thursday, August 18, 2005


Fred Ferris
GAU 2128